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ROYAL BOTANIC GARDENS, KEW

XLVIII.—A BOTANICAL TOUR IN SOUTH AFRICA.

J. HUTCHINSON.

The opportunity for sending a Botanist from Kew to South Africa has long been desired, both by the South African Botanists as well as by ourselves. Fortunately, the grant from the Empire Marketing Board to Kew for the purpose of sending out collectors as in old days, has made such visits possible, and I was able to depute Mr. J. Hutchinson, Assistant in the Herbarium, to undertake this mission during the autumn, winter and spring of 1928-9.

Mr. Hutchinson has prepared the following brief sketch of his tour, rendered all the more valuable by the very kind help he everywhere received in South Africa. The results he has obtained both in living and Herbarium material, and the friendly relations existing between Kew and botanists and others in South Africa which have been greatly strengthened as a result of his visits, have, I consider, fully justified the foresight of the Empire Marketing Board in making this grant to Kew, to enable us to become better acquainted with the vegetation of the Empire and its economic possibilities. A. W. H.

I left Southampton by the Union Castle Royal Mail Steamer *Saxon* on July 27th, 1928, and after a pleasant voyage arrived at Capetown early in the morning of August 13th. Whilst at Madeira I took the opportunity of visiting the interesting garden of Dr. Michael Grabham, an old and valued correspondent of Kew, now a hale and hearty veteran of 90 years of age. Amongst many interesting plants which took my eye was a fine specimen of *Magnolia grandiflora* about 60 ft. high and with a trunk quite 6 ft. in circumference; whilst its near relative *Liriodendron Tulipifera* towered 80 ft. high and had a girth of 12 ft.

At Cape Town it was a pleasant surprise to find several botanists on the quay to give me a welcome, and this proved to be but a foretaste of the constant help and kind hospitality which I received during the whole of my stay in South Africa. Mrs. F. Bolus and Mr. N. S. Pillans of the Bolus Herbarium, Professor R. H. Compton, Director of the National Botanic Gardens, Kirstenbosch, together with Dr. R. Marloth and Mr. Griffiths representing the Botanical Survey, were there to give me their valuable help and advice at the outset, and plans were soon forthcoming for several interesting collecting excursions in South-Western Cape Colony. Within half-an-hour of landing I was transported by Mrs. Bolus and Mr.

Pillans and introduced to the botanical treasures of the Cape Flats near Table Bay and, like Burchell, "As soon as we had passed the houses . . . my attention . . . was entirely engrossed by the rich and wonderful variety of plants that grew in every spot . . . and I recognised some well-known flower which I had seen nursed with great care in the green-houses of England." On account of rather wet and unsettled weather the first few days were mainly occupied in inspecting the National Botanic Gardens at Kirstenbosch and the Bolus Herbarium. For this purpose Professor Compton and Mrs. Bolus were very helpful and gave me every facility for study. I was very pleased to find still preserved in and around Kirstenbosch a considerable quantity of the Silver tree, *Leucadendron argenteum* R. Br. The National Botanic Gardens at Kirstenbosch have perhaps the finest site for the purpose in the world. Frost is unknown, the annual rainfall is sometimes more than generous, and the natural scenic beauty of the gardens and the surrounding districts is wonderful. It is therefore an ideal situation for the cultivation of much of the extraordinary flora of the South Western districts. Such a salubrious climate is, however, not always suitable for representatives of other floral regions in South Africa. In fact to be in any way adequately represented, South Africa needs as many as five separate botanic gardens, one for the South-Western region represented by Kirstenbosch, and one each for the wonderful Karoo flora, for the flora of Namaqualand, for Natal and for the Transvaal. It is pleasing to know that something is being done in this direction, for owing to the generosity of the late Mr. James D. Logan of Matjesfontein, a Karoo garden has been established by Professor Compton at Whitehill near Matjesfontein, where the rarities and interesting plants of the Karoo are being grown.

Owing to the kindness of Mrs. Bolus, to whom I am also indebted for much hospitality, I had as companion and guide in exploring the Cape Peninsula and other parts, Mr. N. S. Pillans, Assistant in the Bolus Herbarium, who spent upwards of a month with me and was of very great assistance then and throughout my stay in the Union. With him I explored a considerable portion of the Cape Peninsula and the country as far as Saldanha Bay, and he accompanied me on a trip to Namaqualand with Mr. J. Logan, which I shall mention later. I also had the pleasure of accompanying him to the flower shows at Caledon, Tulbagh and Ceres, at which he acted as judge. At these centres we usually spent two or three days collecting.

For travelling purposes* Dr. I. B. Pole Evans, C.M.G., Chief of the Division of Plant Industry of the Department of Agriculture and Director of the Botanical Survey, had kindly arranged for me to have the use of a Government motor-car, and I availed myself of this for upwards of a month. As running costs proved somewhat high,

* I am also indebted to the South African Government for facilities for travelling by rail, of which, however, I had but little opportunity of making use.

SKETCH MAP OF SOUTH AFRICA
SHEWING
THE MAIN ROUTE FOLLOWED BY Mr J. HUTCHINSON
FROM
AUGUST 1926 TO APRIL 1929
SCALE
Miles
0 20 40 60 120 180 240
Dongola
Messina
Limpopo River
Louis Trichardt
Lake Fundusi
Blaauwberg
Pietersburg
Woodbush
Potgietersrust
Nylstroom
Pienaars River
Zeerust
Marico
Rustenburg
Pretoria
Belfast
Komati Poort
Middelburg
Barberton
Mafeking
Johannesburg
Heidelberg
Potchefstroom
Standerton
Vryburg
Vredefort
Wolmaransstad
Bothaville
Volksrust
Bloemhof
Vaal River
Potchefstroom
Orange River
Kimberley
Glencoe
Ladysmith
Colenso
Winton
Harrick
Pietermaritzburg
Durban
Upington
Prieska
Campbell
Griquastown
Witteberg
Bloemfontein
Orange River
Fauresmith
Edenburg
Philippolis
Umzimkulu
Colesberg
Hanover
Riddelburg
Port St. Johns
Uitenhage
Graaff Reinet
Aberdeen
Kendrew
Kokstad
Kenyon
Port Beaufort
East London
Grahamstown
Addo
Port Elizabeth
Humansdorp
Willowmore
Klaarstroom
Oudtshoorn
George
Knysna
Mossel Bay
Riversdale
Swellendam
Caledon
Hermanus
CAPE TOWN
Sir Lowry's Pass
Worcester
Montague
Ceres
Tulbagh
Paarl
Wellington
Stellenbosch
Somerset West
Saldanha Bay
Malmesbury
Piquetberg
Clanwilliam
Citrusdal
Prince Albert Rd
Cradock
Middelpost
Fraserburg
Sutherland
Williston
Brandvlei
Kenhart
Vanrhynsdorp
Kamiesberg
Carnarvon
Calvinia
Loeriesfontein
Okiep
Springbok
Port Nolloth
Orange River
Pella
Vioolsdrift
Warmbad
Keetmanshoop
Gibeon
Mariental
Rehoboth
Windhoek
Omaruru
Karibib
Swakopmund
Walvis Bay
Otjimbingwe
Usakos
Okahandja
Otjiwarongo
Grootfontein
Tsumeb
Namutoni
Ondangwa
Ovamboland
Angola
Portuguese East Africa
Rhodesia
Bechuanaland
South West Africa
Cape Province
Natal
Transvaal
Orange Free State

however, I acquired the use of a smaller and much more economical Citroën car equally suitable for my purposes, and with this little and somewhat ancient vehicle, I covered nearly 7,000 miles of roads during my stay. It served me faithfully and well, except on one occasion, of which I shall speak later. For botanical collecting in a hot climate like that of South Africa, a car is now an essential part of the outfit, since the distances to and from suitable collecting grounds are often very considerable, and dull and uninteresting stretches of country can be passed through rapidly. A week-end was spent at Worcester accompanied by Mr. Dunsdon, who was in charge of the South African floral display at the Wembley Exhibition, and there the Memorial Garden designed by Mr. Naude was inspected. It is beautifully laid out in the middle of the Commonage, and at the time of my visit was gay with the Gousbloom, *Venidium fastuosum* Jacq. (*V. Wylei* Harv.) from Namaqualand. Mr. Naude's sketches of Namaqualand were particularly interesting and revealed to me the amazing beauty of that country in a favourable season. He most kindly took us to collect in the Hex River Mountains and around Brandvlei. A spell of bad weather followed this excursion and necessitated spending some time at the Bolus Herbarium. At this particular spot at Kirstenbosch during the wet winter months the atmosphere is frequently very moist, and the valuable collections of dried specimens and books are apt to suffer from damp. So far funds have not been available to allow for the installation of a permanent heating arrangement, but this should not be long delayed if the specimens are to be adequately preserved. Up to the present, Mrs. Bolus and the staff, who are well aware of the danger, do the best they can with small portable heating lamps, a very risky method in so valuable a place.

On Thursday, August 30th, I accompanied Professor and Mrs. Compton and Mr. N. S. Pillans on an excursion by car to Matjesfontein, to see a portion of the Karoo and visit the Karoo Garden at Whitehill. We went through various places hitherto familiar to me only on the map, including the renowned collecting ground, Sir Lowry's Pass. I was much struck with the complete dominance of the family *Proteaceae* in this area, and especially with the large expanses of various species of *Leucadendron* from there almost up to the Karoo. At that time of the year the mountains and valleys were beautiful with many tints of green and yellowish-greens, due mainly to *Leucadendron*. On my return in the autumn, alas, I was grieved to see much of these wide stretches completely blackened by fires.

A few days were spent in collecting along the foot of the Witteberg en and the Karoo around Matjesfontein, and in this we were joined and greatly assisted by Mr. J. Logan of Matjesfontein, a keen student of botany. The difficulty of travelling by car in some parts of the Karoo was thus early demonstrated to me on these excursions, for the roads, apart from the main trunk roads, are often mere tracks and even the experienced travellers I was with were sometimes

at a loss as to which way to turn. We returned via Karoo Poort, one of Burchell's collecting grounds, of which he gives an interesting description.* In Mitchell's Pass I had the surprising experience of plodding through snowdrifts several feet deep, the result of a spell of exceptionally cold weather. The story of our crossing the swollen river at Ceres and the stranding of our car for some hours in the middle of the stream I must tell in another place; this and other experiences, however, stood me in good stead at a later date when travelling alone.

From September 4th to 6th an excursion was made by car with Mr. Pillans to Saldanha Bay, when we gathered a large number of herbarium specimens. But bad weather compelled us to return sooner than we had intended. Next a most enjoyable week-end was spent in company with Dr. R. Marloth as the guests of Mrs. Solly at Sir Lowry's Pass, where a wealth of *Proteaceae* and other plants were seen to great advantage. A considerable portion of Mrs. Solly's estate is in the nature of a botanical reserve. On leaving here I botanised alone in the Hottentots Holland mountains behind Gordons Bay. Returning to Cape Town via the Cape Flats I experienced the full force of a violent "sou' easter" and fully realised the great value of the Australian Acacias (*A. saligna* Wendl., etc.), in binding the sand in this wind-swept area. These plants have made life possible on these exposed flats, the *locus classicus* for many South African species of plants.

The next three weeks (September 14th to October 8th), were devoted to visiting the flower shows at Tulbagh, Ceres and Caledon with Mr. Pillans, collections being made in the neighbouring districts. Botanical excursions were also made to Paarl, and in addition I spent several days alone exploring the Cape Peninsula as far as Cape Point. On Monday, 8th October, Mr. Pillans and I left by train for Matjesfontein, whence we started by car on a "grand tour" of Namaqualand and Bushmanland with Mr. J. Logan as our very able guide. He generously used his large Studebaker saloon car for the purpose and devoted his whole energies to making the tour a success. Whilst a car may be regarded in many respects as a very great asset to a botanical collector, it depends largely on the willingness of the driver, even though he be a botanist, to stop on every occasion demanded by the untrammelled eyes of the passengers. When driving alone I frequently found at war within me the rival claims of the motorist and of the botanist, the one for speed and continued progress, the other for stopping to gather some interesting plant. The remark "We shall probably see it further on" is fatal, and I must record that Mr. Logan, however great the gradient or smooth the surface, always stayed our progress on request, and frequently through his own observant eyes spotted some rarity. Full particulars of this most interesting trip, when we found Hantams Berg near Calvinia too drought-stricken to warrant a visit, Bushmanland suffering from a four years' drought, and the return

* Burchell, Travels, 1 : 207.

journey close by the now famous Verneuk Pan and down the Zak River, will be published in due course. I shall not readily forget our traverse of the sand-dunes of Bushmanland, nor the long descent into Pella, at that time of year a veritable " inferno," near the banks of the Orange River. At Ookiep, Mr. Good was of great assistance, and a special excursion to Klipfontein, a small post on the Port Nolloth Railway, yielded a wealth of material. There I saw for the first time the great beauty of *Venidium fastuosum* Jacq. (*V. Wylei* Harv.) in its native habitat.

This most enjoyable trip was followed by a few days in drying the material collected and in despatching a quantity of living plants to Kew. After that a week-end was spent with Professor R. H. Compton and his family under canvas at the top of the Gydouw Pass, when we collected in the neighbouring mountains, many of which had unfortunately suffered from recent fires. On October 30th, I began a long trek, which was not to end until the middle of December, beginning at Cape Town and ending at Pretoria. For a part of this journey I was fortunate to secure the company of Mr. Jan Gillett, of Oxford, a keen young botanist, and Dr. Marloth kindly accompanied me as far as Warmbad beyond Barrydale. We naturally botanised all the way, visiting such interesting places as Ladismith, Seven Weeks Poort, Calitzdorp, Great Zwartberg Pass, Cango Caves, and Oudtshoorn. In the Montagu Pass on the way to George we fortunately met on the road Mr. Fourcade, who has made a special study of the flora of the country from Mossel Bay to Algoa Bay. He acted as our guide for several days, exploring the Knysna and Zitzikamma Forests, and we stayed with him at Witte Els Bosch, where we were able to compare notes in his excellent herbarium and library. We visited the Forestry Station at Deep Walls near Knysna, Mr. Laughton, in charge, very kindly assisting us in every way. It was interesting to see at last the celebrated giant specimen of *Podocarpus falcata* R. Br., about 127 ft. high and 21 ft. 4 in. in girth, six feet from the base.

At Port Elizabeth I was pleased to meet at the suburb of Humewood, Mr. H. C. Long, formerly a student gardener at Kew, who has transformed much of the locality from a wilderness of *Acacia* and sand into a beautiful place reminiscent of the Chines of Bournemouth and the Isle of Wight. I was glad to learn the town authorities were fully aware of Mr. Long's value to them, and he has since been given entire charge of the parks and open spaces on the retirement of Mr. Butters, whom I also met. At Port Elizabeth we were joined by Mr. R. A. Dyer, a member of the botanical survey stationed at the Albany Museum, Grahamstown. Dr. Pole Evans had arranged that wherever possible a member of his staff should accompany me on collecting excursions, an arrangement which proved to be a very happy one and of great help in every way. For a time Grahamstown was made our headquarters, and there much to my regret Mr. Gillett was due to leave me to join his parents in the Transvaal. He had

assisted me very much all the way from Cape Town and the journey thence might have been very different but for his congenial company. The Addo bush between Port Elizabeth and Grahamstown was of great interest. It is a distinct botanical formation, very different from the real Karoo with which it is usually classed. Mr. Dyer and I left Grahamstown, where I had been delayed for a few days by influenza, on November 26th, for our long road journey to Durban, whence he was to return by train. We collected on the Katberg and along the whole route via East London, Komgha, Libode, Port St. Johns, Flagstaff, Kokstad (where we unexpectedly met Dr. E. P. Phillips from Pretoria), Umzimkulu, Richmond and Pietermaritzburg. At the last place some time was spent with Dr. Bews and Dr. Sim, including visits to the College and the Botanical garden. There Mr. Kidd, a Kewite, worthily carries on the Kew traditions and made us very welcome. At Durban, which was reached on December 7th, I was much interested to see the Botanic Garden and herbarium of which the late Dr. Medley Wood was so proud. Under the care of the municipality the botanic garden is now in rather a poor state, which is much to be regretted. Scarcely any of the magnificent trees have labels and the place is generally untidy and neglected. The streets were at that time gay with the beautiful Flamboyant, *Delonix regia* Raf. (*Poinciana regia* Boj.).

Mr. Dyer having now returned to Grahamstown, I had to essay the somewhat rapid journey in three days to Pretoria alone, for I had received a message that General Smuts, whom I had seen in Cape Town, would be starting for a botanical tour of the Northern Transvaal on Dec. 14th, in which I had been invited to participate. I reached Pretoria at midday on Dec. 13th, by way of Pietermaritzburg, Howick, Estcourt, Colenso, Ladysmith, Glencoe, Newcastle, Volksrust, Standerton, Heidelberg and Johannesburg. On this journey I did not add much to my collections, but I experienced a vivid and somewhat terrifying thunderstorm which descended on me from the Drakensberg whilst still 30 miles from Newcastle and somewhat late in the day. Under such conditions the so-called " brown turf " roads were something of a nightmare from a motoring point of view. I remember " sitting tight " for quite an hour, not daring to move, whilst the lightning played around the little car and the road and the landscape gradually disappeared in the downpour, no doubt a common enough experience to a South African, but rather disquieting for a visitor. The afternoon at Pretoria proved all too short to visit the herbarium and meet the Staff. Early next morning saw General Smuts helping to carry out my impedimenta from the hotel to three waiting cars completely supplied for a lengthy tour in the wilds of the Northern Transvaal, the General providing two of the cars, the third belonging to Mr. Arthur Gillett. Mrs. Gillett, an enthusiastic botanist who had already collected extensively in the Union, accompanied us with her two sons, Jan and Nicholas, and together with General Smut's son, Jannie Smuts, and a native

servant, we were a very enthusiastic and happy party, Mr. Gillett and his younger son making a study of the bird life.

This delightful trip will long remain a happy memory, but I cannot tell the full story here. It will be sufficient to indicate its main features. We travelled northward by the Cape to Cairo road via Nylstroom, Potgietersrust and Louis Trichardt as far as Messina, botanising by the way at the most likely places. Two lateral excursions were of very great interest, one from Louis Trichardt along the Zoutpansberg to Lake Fundusi, a little-known lake about 35 miles to the eastward, the other to the beautiful country at Woodbush, east of Pietersburg, to all of which General Smuts proved an enthusiastic guide and leader. From Messina, where we were sumptuously entertained by Mr. Emery, the manager of the mine there, we visited the botanical reserve at Dongola, recently acquired by the Botanical Survey. There were seen magnificent specimens of the Baobab, *Adansonia digitata* Linn., one particularly large example measuring 94 ft. around the trunk. It seemed to me as if the Baobab, in this its most southerly point of distribution, reaches also its maximum development. Its distribution southward, except for a few small isolated specimens, is effectually barred by the Zoutpansberg and its extension, the Blaauwberg. In the Zoutpansberg and along the Limpopo west of Messina, we met with many species of the tropical flora with which I am more familiar, including fine examples of my own *Bridelia mollis* and small forests of Prain's interesting *Androstachys Johnsonii*, both of these occurring in quantity on the Zoutpansberg near Wylie's Poort. The latter place provided a day or two of most interesting botanising. In the Zoutpansberg and in the Eastern Transvaal in the neighbourhood of Barberton, I was able to see at its best one of South Africa's most delightful leguminous shrubs, *Bauhinia Galpinii* N.E. Br., resembling in the distance masses of red Azalea, and a most desirable subject for the warm greenhouse in Europe. The Zoutpansberg range of mountains and the Blaauwberg are scarcely touched botanically and deserve a thorough investigation, for it is here that the great tropical flora to the north seems to end and the flora typical of South Africa begins. The vegetation is therefore of surpassing interest from a phytogeographical point of view.

After Christmas I was invited to make my headquarters at General Smuts' farm at Irene, some miles to the South of Pretoria, and every facility was given me to dry my collections. From there I made several long excursions with various companions, besides botanising a good deal locally with General Smuts and the Gilletts. Part of the Magaliesberg was explored with Miss Verdoorn, of the National Herbarium (lately Assistant for South Africa at Kew) and Mr. van Baalen, also formerly at Kew and now head-gardener at the Union Buildings. Oh the 5th January I arrived by train at Louw's Creek, in the Eastern Transvaal, with Dr. Pole Evans and his assistants, together with Mr. van Baalen, and starting from there by

motor caravan we explored the region from Barberton to Komati Poort, including the Maid of the Mist mountain and the delightful country towards the Hora Mine. The advent of a violent storm compelled us to hasten from the latter place, for after such storms the roads are often impassable for some days. At Barberton I met the veteran botanical collector Mr. George Thorncroft, and Mr. Andrews kindly took us for a most interesting mountain drive towards the Lomati Falls. At Komati Poort we botanised on the Lebombo Mountains in Portuguese Territory.

On the 21st January I accompanied Dr. Pole Evans on a most interesting trip to the Blaauwberg; starting by motor caravan from Potgietersrust in the early morning of 22nd January. About 9.30 we arrived at the farm of Mr. Neethling at Swerwerskraal, who had invited us to see the flora of the neighbourhood. A day was spent there very profitably. Next day we travelled towards the Magalakwin River, a large tributary of the Limpopo, on the banks of which I was particularly interested to recognise a rich stand of *Croton Gobouga* S. Moore, the bark of which is a reputed remedy for malaria. Associated with them along the river banks were numerous very fine examples of *Acacia albida* Del., at that time devoid of leaves and looking gaunt and out of place where everything else was green. Dominant in the neighbouring flats was *Terminalia sericea* Burch., with pretty fruits; this tree is one of the commonest in the Northern Transvaal and has very beautiful silky foliage. We followed the "road" on the north side of the Blaauwberg, the rock face on the north side of the range being very beautiful in the evening light, the top obscured by cloud. We slept out that night and I was distinctly relieved that there had been no lions to disturb us as there were at Dongola, near Messina. Next morning we proceeded eastward with the intention of making Pietersburg by evening, but the black turf was too much for the heavy lorry, which frequently sank to the hubs, and we were forced with reluctance to return by the way we had come.

The next few days were occupied in collecting towards Pienaars River with Mr. Mogg, and on a solitary trip to the Belfast district, a very cool part of the Transvaal with a rich temperate flora. I am much indebted to Mrs. Franken, a friend of Mrs. Smuts, for assistance whilst at Belfast. Through her agency a special trip to collect on Mr. Maskew's farm at Suikerboskop was made possible and yielded good results.

On 6th February I started from Pretoria with Dr. E. P. Phillips for a tour of the Western Transvaal by way of Rustenburg, Zeerust, Mafeking, Vryburg, Wolmaransstad and Potchefstroom. At Rustenburg a visit to the Government Experimental Station proved very interesting, especially the experiments of growing tobacco in the various kinds of Transvaal soils. At Vryburg the Government Veterinary Experiment Station was novel to me, and I was amazed at the successful result of bone-meal feeding to cattle in order to

counteract the fatal disease known as *lamsiekte*. At Potchefstroom Mr. Saunders kindly showed us the interesting experiments being carried on at the School of Agriculture. On my return to Pretoria a day was spent at Onderstepoort Veterinary Station, where Drs. du Toit and G. de Kock very kindly showed us around.

On February 14th I said goodbye to the many friends at Pretoria and Irene, who had made my time in the Transvaal so profitable, and started my return journey towards Cape Town. My first stop was at Vereeninging to meet Mr. Leslie, who has an excellent collection of succulents. The journey from there as far as Hoopstad was not a particularly pleasant one. It was mainly on a secondary road which usually meant a rough uncharted track over the veld; the gates seemed to be innumerable, and I lost my way once or twice and several times stuck fast in the loose sand. A spade, loose branches and other expedients had then to be resorted to in order to make progress. I abandoned these secondary " roads " at Hoopstad and recrossed the Vaal by the ferry near Bloemhof and proceeded to Kimberley with much more comfort. The whole of this journey produced very little of interest in the way of plant life, the country for the most part being very dry short grass-land and suffering from drought.

At Kimberley Miss Wilman, Curator of the Macgregor Museum, made me very welcome, and introduced me to Mr. S. Tapscott, well known for his interest in succulents. He accompanied me on a trip across the weird and interesting Kaap Plateau as far as the Asbestos Mountains, at that time in a very dry state. For a day or two we followed Burchell's route and visited the remarkable cave, Blinkklip, which he figured and described. At Kimberley Mr. Powell, a local botanist, kindly acted as guide on some excursions. Horticulture at Kimberley is in a backward state, and it was particularly gratifying to see the fine succulent garden now flourishing in the town, mainly due to the energy and enthusiasm of Miss Wilman.

From Kimberley I journeyed in a day to Bloemfontein, but considering the distance covered I gathered very few species of plants. At Bloemfontein I met Professor Geo. Potts; and Mr. Baker, formerly a student gardener at Kew, showed us how, in conjunction with the city engineer, he had transformed the open spaces into beautiful public and zoological gardens. Bloemfontein should indeed be proud of its achievement, especially of its public baths and surroundings, which were the most beautiful I had seen in South Africa.

Two of my previous companions again joined me, Dr. Phillips at Bloemfontein and Mr. Dyer at Fauresmith, the former returning by train from Middelburg, the latter sharing my adventures as far as Le Roux, near Oudtshoorn. The Fauresmith Reserve should prove of great value to farmers in this part of the Upper Karoo, which is very different from the Lower Karoo and presents different problems. Experimental work with fodder plants likely to be suitable

to this region is being carried on besides purely botanical research. Approaching Colesberg the first serious mishap occurred to the car, which, carrying three passengers and baggage, was very heavily loaded. The radiator burst in a vital spot, and we limped into the town at a snail's pace and with innumerable stops to cool the engine. From Middelburg, our headquarters for a few days, excursions were taken in various directions, and a visit was paid to the Agricultural Experimental Station in charge of Mr. Joubert. A profitable day was spent on the Tafel Berg Hall Farm (Mr. and Mrs. Van Ryneveld), and we climbed to the top of the mountain. Further south Roode Hoogte and Naude's Pass proved fertile collecting grounds.

The town of Graaff Reinet is a vivid contrast to the surrounding country, and shows the fertility and possibilities of the driest parts of the Karoo when provided with a plentiful supply of water. Nearly all the streets are lined by fine trees of *Cupressus macrocarpa*, Pines, and English Elms, and the gardens were full of grapes and figs, etc. In the botanic gardens are some fine trees, but the grounds generally are in a neglected state. The prickly pear has a strangle-hold on much of the neighbouring country. We made a special trip to Kendrew where we found to our great delight numerous examples of *Euphorbia Obesa* Hk. f., and we collected about two dozen examples and transported them to Kew, where they are now flourishing. In the neighbourhood of Aberdeen, after a long search, we located a fine stretch of *Mesembryanthemum Bolusii* Hk. f. I collected a few typical specimens together with a few of the smaller and similarly spotted stones amongst which they grow. These were shown recently at the annual conversazione of the Royal Society and aroused much interest. Our progress to Willowmore was effectually barred by the Groote River, which was flooded as the result of a storm in the mountains a long distance away. We obtained accommodation at the farm of Mr. Greeff at Hoogekraal, who generously made us welcome. At Willowmore the farm of Mr. Codner (storekeeper in the town) was of great interest, and owes its prosperity to scientific irrigation and conservation of water.

The 15th March proved to be an eventful day. The country between Willowmore and Klaarstroom was very dry and drought-stricken, and very similar in many ways to that between Montagu and Barrydale which I had come through on the outward journey. We decided, therefore, instead of staying the night at Klaarstroom, which had failed us for succulents, to continue through Meiring's Poort. In perfect weather we began the descent of the gorge which is a deep rocky defile about 14 miles long, the river at the bottom crossing the road by about 33 drifts. We had collected some interesting plants in the upper portion and were crossing about the tenth drift when the differential gear of the car gave way and we were stranded in about 3 feet of water in the middle of the drift. The story of how we managed to save the car in the subsequent thunderstorm and of our narrow escape from the flood which rendered the

road impassable for weeks, must be told in another place, but it was an experience which will not be readily forgotten. My companion, Mr. R. A. Dyer, was an invaluable help, and I am very grateful to him for all he did under exceptionally trying circumstances. At De Rust, the small village at the mouth of the gorge, the local medical officer, Dr. Smit, and the brothers Du Fosse, were very helpful. During the interval of obtaining spare parts from Cape Town, Mr. Dyer having returned to Grahamstown, I proceeded by train to George and Mossel Bay, where I made collections. The subsequent journey alone through the Robinson Pass, Mossel Bay, Riversdale, Swellendam, Caledon and Hermanus to Cape Town was without special incident, and was made in wet and unsettled weather, which permitted little collecting to be done. I was much impressed during this journey by the vast quantity of the Rhenoster bush, *Elytropappus Rhinocerotis* Less., which in that region has everywhere taken possession of the veld.

The last fortnight was spent at Claremont and Kirstenbosch in sorting my collection into sets, in which work Mrs. Bolus very kindly allowed me the help of the staff of the Bolus Herbarium ; and in botanising on Table Mountain with General Smuts and Professor Compton. To these and all other friends whom I may not have mentioned I tender my warmest thanks for the help and advice received at every stage of my journeys.

The full story and scientific results of my tour will be published elsewhere. Over 3000 species of plants were collected, and wherever possible sufficient material was gathered for making three or four sets. Two sets were left in South Africa, one at Pretoria, the other at the Bolus Herbarium, Kirstenbosch. As it is my intention to compare carefully with the type specimens at Kew and elsewhere the whole of the collection, the sets left in South Africa should have some value, for systematic work in the Union suffers greatly for the lack of type specimens.

Except for the species described during the last decade from the Bolus Herbarium and other South African Herbaria, practically the only type specimens in South Africa are preserved in the Natural History Museum at Cape Town, and the amalgamation of this herbarium with the Bolus Herbarium would be a distinct advantage. It is hoped that it will be possible to assist South Africa by sending over certain duplicate types and also specimens compared with unique types from Kew. It would then be possible for botanists in South Africa to work out more of their own problems and pave the way to the preparation of regional floras, which are so much needed.

Besides the dried collection I was able to collect at intervals a number of living succulent plants which were forwarded to Kew and are mostly growing well. As the season was on the whole a poor one in South Africa, I was somewhat disappointed at not being able to do more in the way of seed collecting, but as I was mainly in each area during the flowering season this was hardly possible.

I sailed from Cape Town on April 12th on board the R.M.S. *Balmoral Castle*, whose captain and first officer gave every facility for the care of the four wardian cases full of rarities, which Professor Compton supplied from Kirstenbosch for cultivation at Kew, most of which survived the journey very well.

XLIX.—FASTIGIATE AND PYRAMIDAL TREES: II*.

VICARY GIBBS.

The Director has asked me to add a supplement to the admirable article on fastigiate trees which appeared in the *Kew Bulletin* No. 4, of the current volume. There are a few trees of this kind which have escaped the author's notice, and of which my long experience at Aldenham enables me to give an account. I have always been interested in aberrant types, whether narrowly upright, weeping or contorted. Mr. Bean says, very truly, that nearly every common tree has a fastigiate form, if one could only find it. He mentions, as exceptions, the ash, the lime, the sycamore and, with the exclusion of one tree, here at Aldenham, the common elm. As to the ash, I found a fastigiate form in Mr. Trotter's grounds at Leith Vale, a year or two ago, and this year we succeeded with two or three grafts, one of which will, I hope, in due course reach Kew. This ash is undoubtedly fastigiate, in the sense that all the boughs turn up vertically, but it is not very narrowly so, and is not therefore so effective as the hornbeam when it takes on that form. I have had for a good many years a lime growing here, about which much the same can be said as about Mr. Trotter's ash. This is *Tilia platyphyllos* var. *pyramidalis*, which appears in the Kew Hand List, as does also its golden form var. *aurea*. My plant is a shapely pyramid about 20 feet high and is doing well. I have not yet come across a fastigiate sycamore. As for our unique elm, that alas was blown down in a gale about a year ago, but we have preserved, and grafted, some of the wood, so that Kew should not be without this long.

Bolles' White Poplar, which Mr. Bean praises, as most ornamental, is a dismal failure in our heavy soil. Its branches keep dying off, and it consoles itself for this by scattering suckers over a very wide area, so that I should be thankful if it had never been planted.

Acer saccharum var. *monumentale* is one of the few narrow forms mentioned as growing at Kew that I do not possess, and the same remark applies to *Alnus incana* var. *Balfourii*. On the other hand I have *Alnus glutinosa* var. *pyramidalis*, which the author has omitted, and which is well worth growing, as it makes a very neat compact specimen. (Plate XII.)

Like Kew, I have two plants of the pyramidal Spanish chestnut, which were originally suckers of the old tree at Mount Mascal; they were given me by the late owner, Sir Vesey Holt.

Besides the *Robina pseudacacia* var. *fastigiata*, and the fastigiate form of the var. *monophylla*, which the previous article records, there

*See *K.B.* 1929, pp. 97–104.

is a third, perfectly distinct and striking form, var. *inermis fastigiata*, which has been growing here for many years, and of which a very good photograph appears in a monograph on Robinias written by me in the Journal of the Royal Horticultural Society for this year.

With regard to the upright growing form of *Ulmus montana*, although it is true that the branches are likely to become decidedly weak and sloppy unless they are trimmed in fairly closely, it is decidedly decorative when this is done.

We have another elm here, *U. nitens* var. *umbraculifera gracilis*, which perhaps cannot be justly included amongst pyramidal trees. The truth is, it is very difficult to draw the line, for whilst no-one can doubt that the Lombardy Poplar is fastigiate, or that our common oak is not, there is no hard and fast line, and many trees whose limbs are inclined to be vertical, yet form so broad a head, that they do not produce a fastigiate effect. The elm under discussion has no central stem whatever, but a mass of thin twigs all about the same size, all nearly vertical, and forming a very neat bush which some might say was like a mason's mallet, about 14 ft. high by 12 ft. across. In form it is not altogether unlike *Carpinus betulus* var. *pyramidalis*.

Besides the ordinary Irish Yew, there is an exceedingly narrow form, growing here, which was given me by Mr. Hornibrook, and is called var. *columnaris*. It is described by him as having the appearance of a folded umbrella.

Other trees omitted are the very narrowly upright form of Scots Pine which is growing at Glasnevin, of which my plant, about 8 ft. high, is the offspring by grafting; two exceptionally narrow forms of *Juniperus chinensis*, of which we are the proud possessors, viz., the green one, and that which is known as "Young's Golden Juniper"; and a narrowly upright form of *Cedrus atlantica*. I saw the last named two years ago in Anthony Waterer's nursery, but alas it was too old to stand removal and died on me. However, I got some young plants from abroad, in pots, which are bound to be all right. Another addition that should be made to the list of Conifers is *Pseudotsuga Douglasii* var. *pyramidalis*, which is now 10 ft. high at Aldenham, and was noticed by the late Henry Elwes in a nursery.

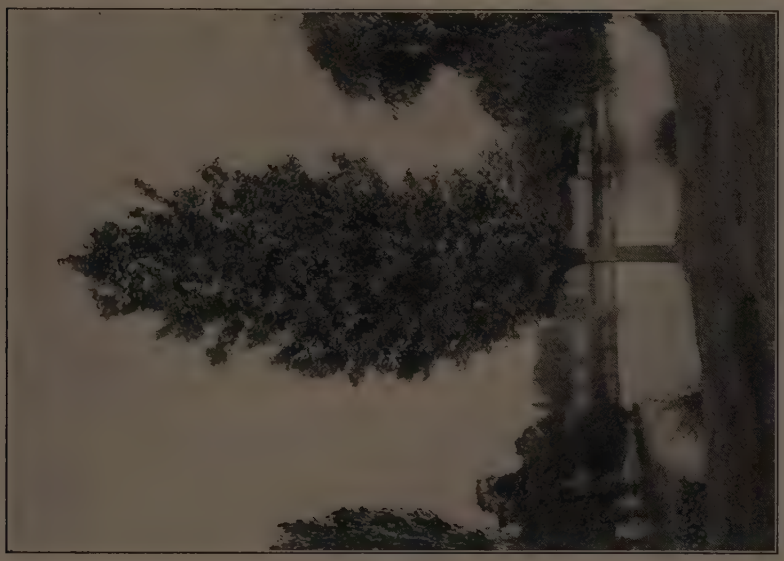
Besides the pyramidal form of our common birch, I think room should have been found for the dwarf form *B. pumila* var. *fastigiata*, which, though grown here for many years and quite healthy, is only 12 ft. high.

Amelanchier florida also, 18 ft. high, is certainly either fastigiate or pyramidal.

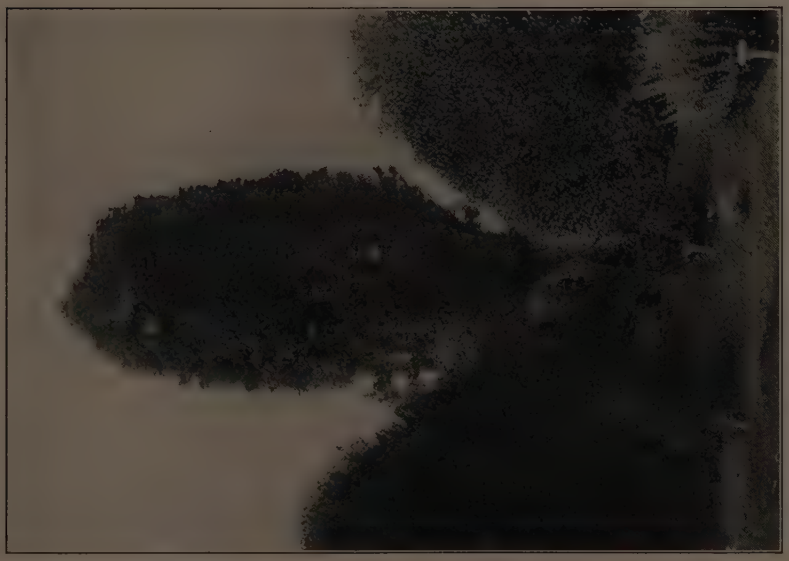
Some of the edible pears also, such as "Charles Ernest," of which we have a plant 16 ft. high, are unquestionably fastigiate in form, as also is the crab apple *Pyrus malus* var. *magdegurgenis*, 13 ft. high.

I will finish off with two fastigiate forms, which can hardly be said to grow to the dignity of trees, but whose narrowness justifies my mentioning them. The first is *Sambucus nigra* var. *fastigiata*.

PLATE XII



Alnus glutinosa pyramidalis at Aldenham.



Sambucus nigra fastigiata at Aldenham.

[*To face page* 286.

A charge of "inelegance" has been brought against it, but, as the photograph (Plate XII) shows, it can be very effective, if judiciously placed, and as it makes a very solid column, it might well serve to block out buildings in some small garden, where a change from the ordinary Lombardy Poplar was required, and great height unnecessary. Our oldest plants are about 20 ft. high by 10 ft. through. If they had only been reduced to a single stem when young, as ought to have been done, they would have been decidedly taller and narrower. Moreover, it has the advantage of being a rapid grower. Strangely enough, although it is not, so far as I know, botanically different from the ordinary common elder, this form seems hardly ever to flower, and never to fruit. Of course this is a great merit, for no one wants seedling elders all over their shrubberies.

The second plant of the sub-tree, or shrub, order, is the narrow form of *Aralia chinensis*. It has the advantage of taking up less room than the type, and the disadvantage (which is not nearly so evident in the American form, *A. spinosa*) of suckering too freely.

I can think of nothing else to add, except *Ginkgo biloba*. When one sees this tree in North Italy it has long sweeping branches, whereas nearly all those one sees in England have very short boughs. However, in the case of one tree here, which is about 26 ft. high, and only 5 ft. across at its widest, the form is indubitably fastigiate, for nearly all the boughs are not only very short but turn straight up, parallel with the stem.

I am greatly indebted to Mr. Vicary Gibbs for his interesting article supplementing the account of fastigiate trees published in the Bulletin and this seems an appropriate place to add one more tree to the list.

During a visit to the Hortus Bergianus, Stockholm, in July, Professor R. E. Fries pointed out to me specimens of a fastigiate form of *Populus tremula*, which as far as I am aware has not hitherto been recorded. The trees are closely similar to the Lombardy Poplar in habit and it is hoped that examples may soon be seen at Kew, as specimens have just been received from Stockholm.

A. W. H.

L.—SOME IMPRESSIONS OF SWEDEN.

W. Dallimore.

The International Congress of Forestry Experimental Stations, held in Sweden between July 14th and August 4th of the present year, offered an excellent opportunity of obtaining an insight into problems connected with Swedish silviculture, and the extraction and conversion of timber. At the same time it was possible to pay attention to other questions concerning the country and the people, and in the following notes some of the more important impressions are recorded.

The Congress had three distinct phases. First, an excursion through some of the forests of Southern and Central Sweden,

Skånia and Dalecarlia, lasting from July 14th to July 20th. Then the full Congress at the Forestry College, Stockholm, July 21st–July 28th, which was followed by a further excursion to the forest regions north of Stockholm, extending from July 29th to August 4th. During the tour the country was traversed from Malmö in the south to Stor-Uman in Lappland in the north, and from Stockholm in the east to Åre in the west ; thus it was possible to study silvicultural problems under widely different conditions of soil and climate.

One needs to be in Sweden but a very short time in order to appreciate the great forest wealth of the country, and to realise to what a considerable extent the prosperity of the six million inhabitants is bound up in forests and timber, though there are of course other sources of occupation and wealth. The country is rich in certain minerals, agriculture is of importance, especially in the south, shipping and fishing find employment for many people, and so on ; but all appear to be subservient to, and more or less dependent upon, trees and an adequate supply of timber. There is agricultural land in plenty but even in agricultural districts forests are still the dominating feature of the country side. Trees cover the hills and take possession of ground too poor for agricultural crops, whilst in the vicinity of some of the towns the forest is barely separated from the suburbs. Sweden is rich in lakes, rivers and inlets from the sea, and there again the water line alone limits tree growth. Everywhere, as far as the eye can see, Spruce and Pine dominate the landscape.

Before discussing the various forests visited and the work of the Congress, something more should be said about the country and the people. Sweden extends about 1000 miles from south to north, and as the most southerly point is in about the same latitude as Newcastle-on-Tyne, very varying conditions of life are to be expected. In the south they appear to compare favourably with average conditions in the British Isles, but in the north no doubt the people experience much greater privations. The utilisation of water-power for generating electric current and the transmission of cheap current throughout the country, has been a boon to the people. Most of the houses now have electric light, and farmers and others are able to use electric current for various purposes connected with their business. It is of interest to note that Denmark is supplied with its electric power from Sweden. Telephone and wireless installations have also helped to make the conditions of life easier for the people living widely separated in the rural districts.

In the country most of the houses are built of wood, painted with a venetian-red, oil-less wood-preservative, which is said to be made of ferric oxide, copper sulphate and rye flour, and to be used in a warm state. The red colouring is relieved by white window-frames, and the whole effect is singularly appropriate to the surroundings. The country throughout has a very clean appearance and housewives are very fond of board floors, scrubbed to a degree

of whiteness that is usually only associated with the top of a well-kept kitchen or dairy table. In towns and villages alike the love of flowers was very noticeable and the windows of houses were usually filled with well-grown ' geraniums,' fuchsias, begonias, ferns and other plants. The towns are well furnished with parks, gardens and avenues, many of them unfenced. They are well kept, and visitors are careful to keep them tidy ; paper or other litter is not thrown about. Plenty of seats are provided and they are put to good use ; visitors are rarely seen sitting or lying on the grass. Moreover they rarely walk on the grass. Private gardens of houses are usually well tended and in many places effective displays of summer-flowering plants are made on the railway stations. Very few dogs were noticed about the streets in the towns, and coal fires are not general in houses, two factors which no doubt contribute very largely towards the general cleanliness. A great deal of wood, chiefly birch, is used for heating purposes, and neat, usually round, stacks of chopped wood, often 12 or more feet high, may be seen near every house.

The main features of the parks are trees, shrubs and grass, frequently water ; there is some flower gardening but not a great deal. Here and there may be seen beds of roses, usually masses of single kinds, but many of the garden roses are too tender to withstand the winter cold. *Rosa rugosa* is the hardiest exotic rose and is commonly grown. In Southern Sweden a considerable variety of trees and shrubs succeed in the parks and gardens, but as one proceeds north, species decrease in number, until very few are found. *Syringa vulgaris*, *Lonicera tatarica*, and *Spiraea salicifolia* are amongst the commonest and most widely distributed garden shrubs, whilst the latter was practically wild in some places. In northern gardens *Syringa Josikaea* and *Lonicera tatarica* give excellent results. *Pterocarya caucasica* succeeds very well in Southern Sweden, whilst the fastigiate form of the wych elm (*Ulmus montana* var. *fastigiata*), is very popular in parks and gardens. The two commonest avenue trees are *Tilia vulgaris* and *Betula verrucosa*, whilst the horse chestnut is planted in some places. As seen in Sweden the birch is the most effective road and street tree imaginable. Of moderate growth and graceful habit, it can be allowed to develop to its full size, even in comparatively narrow roads.

Aristolochia Sipho and *Lonicera Periclymenum* are two of the commonest climbing plants used in Sweden, whilst the most conspicuous hedge plant is *Caragana arborescens*, and a very good hedge plant it makes. Other hedge plants are whitethorn, *Pyrus Aucuparia* and *Ulmus montana*.

In and about Malmö, apple, pear and plum trees are seen in many gardens but crops of fruit were poor. Apple and pear trees grow as far north as Central Sweden but fruit was scarce, and I was informed that a crop rarely matures more often than once in five or six years. Small fruits such as gooseberries, black and red currants,

raspberries and strawberries are widely grown and they were cropping well, in fact there were heavy crops of red currants in Lappland. Wild strawberries are very common in some parts of the country, and they were being gathered in large quantities for home consumption and for market.

Tomatoes, cucumbers, melons, lettuces, radishes, carrots, cabbages, cauliflowers, beetroots, fennel, beans and peas are regular market garden crops, and they are seen in all the markets with the small fruits mentioned above.

There is a good collection of trees in the public gardens in Malmö, and that a considerable variety can be grown in Stockholm is evident from the number seen in the Hortus Bergianus. Some of the most conspicuous were :—*Picea Omorika* 50 ft. high, *P. jezoensis*, *P. alba*, *P. excelsa* and a wide range of its varieties, including a form with proliferous cones, and the native variety *virgata*. *P. Engelmanni*, *P. pungens* and var. *glauca*, *P. obovata*, *P. orientalis*, *P. Schrenkiana* 35 ft. high, *Abies sachalinensis*, *A. Veitchii* 40 ft. high, *A. concolor*, *A. homolepis* 30 ft. high, *A. cephalonica*, *A. subalpina* 20 ft. high, *Pseudotsuga glauca*, *Quercus rubra*, *Corylus Colurna* 20 ft. high, *Populus tremula* var. *fastigiata*, a variety hitherto unknown to us in England, and many others. There are trees of *Quercus pedunculata* 3 ft. or so in trunk diameter, and others almost as large in the grounds of the Forestry College near by, although the species finds its northerly limit 20 miles north of Stockholm. Several Western N. American Conifers were noted growing well considerably north of Stockholm, but more conspicuous trees were *Pinus Cembra*, sometimes much more open in habit than Swiss trees, and *Abies sibirica*. Here and there *Larix europaea* was noted, usually covered with *Chermes*, and a small plantation of *Larix sibirica* was seen in Lappland. On the Karsholm estate, Kristianstad, a tree of *Liriodendron Tulipifera* about 50 ft. high and 5 ft. 1 in. in girth at 4 ft. from the ground, was noted. At Skokloster, between Stockholm and Upsala, there is an exceptionally fine avenue of old trees of *Tilia vulgaris* which have the appearance of having been severely pruned or pollarded at an early period of their existence.

Agriculture appears to have attained a high standard of perfection in Southern Sweden. The plains of Skåne are largely composed of very fertile land ; there, excellent crops of wheat, barley, rye and oats were beginning to ripen. The hay crop was particularly heavy. An oat and vetch mixture is grown for green fodder, and lucerne is cultivated in some places ; there were large tracts of sugar beet and potatoes, and tobacco is also grown. Away from this fertile area farming becomes more difficult. A great deal of the land is strewn with large boulders and it is only after the laborious removal of huge stones that the ground can be worked at all. Moreover, in places where land clear of stones is found, the climatic conditions are less favourable than in Skåne. Potatoes are grown in large quantities in the warmer parts of the country, and even in Lappland

small areas are planted. Many of the potatoes grown on peaty soil are distilled for alcohol, and special varieties have been selected for planting in the colder districts. Barley appears to be grown further north than any other corn crop. Farmers were in the middle of the hay harvest at the time of my visit. Hay is not made as in England, but the grass, soon after cutting, is placed on wooden racks and dried. The racks are of varying length and 5 to 6 ft. high, with about five rails. The lowest rail is placed in position and on it a generous layer of grass is hung. Another rail is added on which more grass is placed, and so on until the rack is filled. Women assist in the work. A good deal of the hay appears to be rye grass and clover, but in some places there is meadow hay. In the south of Sweden Friesian cattle are preferred to other breeds. In Central Sweden there are a good many apparently cross-bred Ayrshire cattle, which further north give place to a North Swedish polled breed, mostly white with black or brown blotches and streaks. This breed is said to be very hardy, and gives milk rich in cream. There is also a North Swedish type of horse; a small sturdy animal with short, stout legs, heavy neck and shoulders, rather short body and heavy mane and tail. These animals appear to be of considerable strength for their size, and they are stated "to be considered the most suitable for work in the forests where they often have to be driven through deep snow and over bogland. A small horse of this breed is expected to pull a load of 3 to 4 tons."[1]

Agricultural land in Sweden is said to be limited to 10 per cent. of the country.

Conspicuous Wild Plants.—On a tour devoted to silvicultural questions it is only possible to pay passing attention to other matters and this was so with the general flora. The undergrowth in the different forest areas varies considerably, but as a rule there are a few dominating plants with others in small numbers. However, in passing through the country an idea of the general flora is obtained and opportunities occur of noting a few striking plants. Three forest plants that appear almost everywhere are *Linnaea borealis* *Vaccinium Myrtillus* and *V. Vitis-Idaea.*

In many respects the general flora of Sweden bears a close resemblance to that of England, and numerous familiar British plants were noted throughout the country. *Epilobium angustifolium* was everywhere, sometimes in very large masses and particularly rich in colour. *Filipendula* (*Spiraea*) *Ulmaria* was also common from south to north, its fragrant flowers making their presence known from a considerable distance. *Silene Cucubalus* and *Lychnis dioica* were of general occurrence, the pretty blue flowers of *Campanula rotundifolia* were constantly in evidence, wild strawberries (*Fragaria vesca*), made the ground red in some places and the berries were being gathered and marketed by the bushel; *Juniperus communis* in varying habit, from prostrate plants to vigorous erect bushes, was

[1] Kramfors Aktiebolag, its Development and Organisation, 1929, p. 29.

very common ; *Vaccinium Myrtillus*, *V. Vitis-Idaea* and to a less degree *V. uliginosa* grew in both shady and exposed places ; the bird cherry was seen from south to north, as were other familiar plants. Two very attractive wild plants in southern Sweden were *Campanula persicifolia* and the cornflower (*Centaurea Cyanus*). The former appeared in groups of varying size in grass land and by the sides of roads, whereas the latter was very effective amongst the ripening corn. These two blue-flowered plants, with *Campanula rotundifolia*, the red-flowered willow herb, the cream-coloured meadow-sweet and several large, white-flowered Composites, especially chamomile, were effective over large areas of ground.

In the woods one of the first plants to attract attention was *Linnaea borealis*, and it was a common plant to the end of the tour, varying somewhat in the size of the flowers and widely in the inner colouring of the corolla, but always the same dainty, intriguing plant. Hitherto I had only known *Linnaea borealis* under cultivation, and had thought it unworthy of commemorating the name of the great Linnaeus. My visit to Sweden caused me to alter my opinion. Growing amongst the mossy undergrowth of the forests, it appears as one of the daintiest plants imaginable, while its bell-like flowers add a delicious fragrance to air already sweet with the perfume of pine, spruce and birch. The name of the great naturalist could not have been given to a more appropriate or charming plant. Lily of the Valley is common in many places and several forest areas were carpeted with *Anemone Hepatica* and *A. nemorosa* ; *Anemone vernalis*, however, was rare. Several orchids, including *Listera ovata*, *Habenaria bifolia* and its variety *chlorantha*, *H. odoratissima*, *Goodyera repens*, and *Orchis maculata* were noted. There were many ferns ; the oak fern (*Polypodium Dryopteris*) was particularly common, in fact it is used to designate a type of forest soil as at Flottaforsmyren in Lappland, where a mixed forest of pine, spruce and birch was officially described as being partly of the *Sphagnum*-rich *Dryopteris*-type and partly of the herbaceous type. The beech fern (*Polypodium Phegopteris*) was often found but in smaller quantities than the oak fern. At the waterfall of Tännsfordson near Åre a rare fern, *Cystopteris montana*, was noticed. *Gypsophila fastigiata*, which is said to be rare in Sweden, was found forming dense, deeply-rooted tufts on sandhills at Kumbelnäs near Mora, and in this place *Arctostaphylos Uva-ursi* was proving useful as a sand binder. *Majanthemum bifolium* was very common in forests, and mosses, including several club mosses, were luxuriant. The following plants in addition to those before mentioned were frequently met with during the tour. *Stellaria nemorum*, *Lathyrus vernus*, *L. sylvestris*, *Vicia sylvatica*, *Convallaria majalis*, *Polygonatum officinale*, *Lamium Galeobdolon*, *L. bifidum*, *Asperula odorata*, *Anchusa officinalis*, *Lycopodium clavatum*, *L. anotinum*, *Arabis arenosa*, *Thalictrum simplex*, *Dianthus deltoides*, *Galium album*, *G. uliginosum*, *Pyrola intermedia*, *P. rotundifolia*, *P. secunda*, *Moneses* (*Pyrola*)

uniflora, *Nymphaea alba* var. *candida* (a name given in Sweden to a form that appears to be smaller flowered than *N. alba*), a pink-flowered form also occurs wild in Sweden and is protected, *Parnassia palustris*, *Calla palustris*, *Pinguicula vulgaris*, *Drosera rotundifolia*, *Geranium silvaticum*, *Viola biflora*, *V. tricolor*, *Cornus suecica*, *Paris quadrifolia*, *Calluna vulgaris*, *Erica Tetralix* (occasional in the south), *Rubus Idaeus*, *R. arcticus* in the north, *R. Chamaemorus*, *Betula nana*, *Andromeda polifolia*, *Ledum palustre*, *Empetrum nigrum*. In the mountains about Åre, *Loiseleura procumbens*, *Phyllodoce coerulea*, *Alchemilla alpina*, *A. alpestris*, *Saxifraga azoides*, *S. stellaris*, *S. oppositifolia*, *Salix herbacea*, *S. glauca*, *S. lanata*, *S. repens*, *Arctostaphylos alpina*, *Bartsia alpina*, *Astragalus alpinus*, *Gentiana campestris*, *Pinguicula lapponica*, *Sieboldia procumbens*, *Diapensia lapponica*, *Silene acaulis*, *Erigeron acris*, *Cerastium alpinum*, *Veronica alpina*, *Selaginella selaginoides*, *Lycopodium alpinum*, *L. Selago*, *Viola uniflora* and *Aconitum Lycoctonum* var. *septentrionale*, the latter in damp and sheltered situations attaining a height of 8 feet, were seen.

Forests.—The forests of Sweden are computed to cover about 57 per cent. of the country, or about 23·6 million hectares. They are owned partly by the State and partly by companies and private owners, whilst there are some communal forests. In most instances the holders own very extensive areas, and in both State and private forests highly organised systems of management have been evolved, the systems changing somewhat from time to time, as it becomes necessary to meet growing demands for different qualities of timber. At one period there was a very considerable demand for small timber for the manufacture of charcoal for iron smelting, and the smaller classes of timber were encouraged. There is still a considerable demand for charcoal, but pulp wood and heavy classes of timber are more valuable, therefore wider spacing of trees and a longer rotation period are being put into practice.

A system of selection-felling prevails in most places ; sometimes limited areas are clear cut, or group-felling, practised. As a rule a particular system of management is applied to a very large area, but here and there different systems of management are noticed, almost side by side, in restricted areas. This is explained by the prevailing communal forest system. From what could be learned communal forests were in the first instance divided by a strip system of partition between a few families residing within their limits, the strips running through the entire length of the forest. On the death of an owner his section was divided amongst all his sons and daughters, the strip method of division still being followed. This has gone on until some of the strips may now be only a few metres wide and as much as ten kilometres long. The law allows one or more members of a family to purchase the interests of others, but the forest or portions of the forest cannot be sold to a company. The system naturally results in a multiplicity of owners, hence the different systems of management that prevail side by side.

Timber from state forests is sold to various lumber firms, but the timber cut in company-owned forests is often sawn or otherwise used by the company concerned.

Some of the forest-owning companies have very wide interests, not only in timber but in other industries to which the use of wood in one form or another is complementary. Thus the Stora Kopparbergs Bergslags Aktiebolag—*i.e.*, The Great Copper Mountain Company Limited—and for general use shortened to The Bergslag Company, has very extensive agricultural, forestry, mining and manufacturing interests in Central Sweden, largely in Dalecarlia and Norrland, with headquarters at Falun, and extensive mills at Skutskär on the Gulf of Bothnia, to which timber is floated down the Dalälven river. The Company owns very rich ore deposits, about 1,000,000 acres of forests, of which 750,000 acres are productive, and controls water power to the extent of 200,000 horse power. The Kopparberg Mountain at Falun was the original source of the company's activities, and as early as the thirteenth century the founders of the company were working copper from the Falun mine. Almost from that time the company, which claims to be the oldest Joint Stock Company in the world, has been interested in forests; in the early days in connection with timber required for the mine, and in modern times to meet the demands of numerous developments. It is interesting to note that from the company's records a great deal of timber was required in the early centuries for fuel as well as for building purposes. The mine was worked by lighting large fires of wood to heat the rock, after which water was poured over the rock to make it crack. The large consumption of wood necessitated the company turning its attention to forests and the present extensive holdings were thus gradually built up. Charcoal has always been required in large quantities by the company for smelting purposes, and at the present time, in their Bysjön Works at the Tuna Rapids, in the river Dalälven, there is an annual output of 4,250,000 cubic feet of charcoal, 1,800 tons of wood tar, 1,000 tons of acetate of lime, 150 tons of methanol (methyl alcohol), 65 tons of miscible wood naphtha, 35 tons of allyl alcohol, and 150 tons of wood tar oil. In addition to the charcoal made in special retorts at the Bysjön Works a large quantity is made in forest charring stacks, enough in fact to make up the 6,000,000 cubic feet of charcoal required each year for the production of 60,000 tons of pig iron when made in electric pig-iron furnaces. From their Kvoensveden Mills on the same river, 70,000 tons of paper and building board, made chiefly from spruce, is turned out annually, while the company advertise their annual production of sawn wood as 35,000 standards.

At Falun the company has an extensive and well-arranged museum, in which its activities from early days are demonstrated. An idea of the company's interests and its position in industry may be gathered from the foregoing figures and the fact that amongst other manufactures, the Domnarfvet Steel Works, belonging to the

company, turn out 125,000 tons of finished iron and steel per annum ; the steel manufacturing plant produces 3,500 tons of rail spikes, bolts and cut nails, as well as crowbars, axles, etc., whilst a basic slag mill has a capacity of 16,000 tons of fertiliser per annum. The higher staff at present numbers about 500 ; regular workmen 6,000 ; seasonal workers, agriculture and lumbering, about 2,000. Including the families of permanent employees, it is estimated that 25,000 people are dependent for their livelihood upon this important company. The company has excellent welfare schemes for the benefit of their employees, which embrace housing, medical attendance, pensions, etc. ; and it certainly appears to be a model of industrial organisation. This is one of many similar companies operating in forestry, timber and timber-producing commodities.

In the southern parts of Sweden, and more particularly in the fertile regions of Skåne, broad-leaved trees abound, and at different points in this province, spruce and Scots pine are said to find their southern limit of natural distribution in Sweden. Beech is the most important broad-leaved tree in Southern Sweden, pedunculate oak, mountain elm, aspen, ash, common and grey alder, goat and crack willow, and a few other trees occurring in mixed forests or near water. Mountain elm (*Ulmus montana*) is the prevailing elm. *U. laevis* also occurs, but I did not see it in quantity. In favoured localities beech grows to a considerable size, 90 to 100 ft. high, with old park trees upwards of 2 ft. in diameter ; forest trees are equally tall but less in diameter.

Further northwards the land becomes less suitable for agriculture and a high percentage of the country is covered by profitable forest. Much of the land is strewn with large boulders ; where farms have been established a great deal of labour has been expended upon the removal of huge stones. As Central Sweden is approached, broad-leaved trees become scarcer until the only one left that has any considerable commercial value is birch. *Alnus glutinosa*, *A. incana*, *Populus tremula*, *Pyrus Aucuparia*, and *Salix Caprea* are found very far north but not in commercial quantities. *Pyrus Aucuparia* in Norrland and Lappland is used as a hedge or screen, and is often planted in a circular manner to enclose seats.

Wherever satisfactory soil conditions prevail, pine and spruce are tall and clean but never of large girth, rarely more than 4 ft. at breast high. The tendency at present, however, is, by greater thinning, to increase the size of the trees. They are of slow growth and natural regeneration prevails in most places. Where conditions are not very suitable for regeneration, assistance is given by tearing up the surface soil by means of forest ploughs or by depositing seeds in prepared patches of ground 3 or 4 feet apart. In low-lying, wet, peaty areas, tree growth is often unsatisfactory or impossible, as it is in the British Isles, and the discovery of means whereby these peaty soils may be turned to profitable account, is one direction in which silvicultural research is being conducted in Sweden and in other countries.

There does not appear to be any waste wood in Sweden. Selected trees are in request for masts and telegraph poles, then the largest timber is sawn into planks and scantlings; of smaller timber a large quantity of birch is used for firewood; medium-sized pine and spruce with slabs and short ends of sawn timber, is used for paper pulp, whilst a good deal of small wood is made into charcoal, for use in iron smelting. Badly-shaped poles are in common use to support the wires of private telephone lines and electric current cables. The best birch is used for furniture and panelling and is very effective in the railway station at Östersund and other places.

Except in the south of Sweden none of the timber is of large dimensions, although the trees are tall, 70 to 100 feet. That sawn into planks is rarely more than 12 to 15 in. in diameter and the pulp wood up to 8 in. It is barked when cut, and much of it is allowed to season in stacks for some months before being sent to the mills, in order to facilitate floating. It is taken to the water-ways in winter and commences its journey down-stream as soon as the ice breaks up, floating being continued until the rivers are again closed by ice. Every log is marked with the mark of the firm to which it belongs and the wood of many firms is sent down together. At suitable points there are sorting booms where the logs are sorted and diverted to the mills of the various owners. The Sandslån timber-sorting boom on the Ångerman River, one of the biggest rivers in Norrland and an important rafting course, was visited to study the method of sorting. The logs for 90 firms are sorted at this boom. A very large acreage of water is divided up into compartments separated by floating plank-pathways. In the first place the flow of the water is so controlled that the logs are diverted to a particular point and their journey checked. They are then directed into a channel or funnel-shaped flume where they float, 'broadside on,' that is to say with their ends pointing across the stream. From this channel there are openings into the various compartments. Men stand on the pathways and with long, spiked poles shoot or drag the logs into the various compartments to which they belong. As a firm's logs are sorted so the logs are made into rafts by means of machinery, pulp logs being fastened together with strong wire, and heavier logs by means of chains. At this particular boom, which is said to be the largest in Sweden, 750 men are employed in sorting from May to October. They work in two shifts of eight hours each, and 18,000,000 logs are stated to be sorted annually. All the floating and sorting work on the Ångerman River is done by the Ångerman River Floating Association. Owners of timber deliver their timber ready marked to the sides of lakes or rivers, or on the ice, at any point from the Norwegian frontier to the coast. From that time the Association is responsible for delivery at Sandslån to the rightful owners.

On arrival at a mill most of the timber for sawing purposes is taken by machinery direct from the water to the saw bench; some

is stacked for winter sawing, but such wood is returned to the water before sawing, the pools at up-to-date sawmills being warmed to keep the water from freezing. As the wood is sawn into various sizes it is sorted, and either stacked in the open to season, or is run direct into a drying kiln. Where timber and pulp mills are worked by the same firm all waste sawn timber is chipped up and sent to the pulp mills. In other mills waste timber is turned into charcoal or distilled. As much as possible of the handling of sawn and unsawn timber is done by machinery.

A good deal of the small wood, tops of trees and small thinnings, is turned into charcoal in the forest, about 50 cubic metres being built up on one hearth. When small wood for charcoal has to be floated, before it is calcined, it is made up into bundles about 18 in. wide and deep, and about 12 ft. long. Years ago the production of charcoal was a profitable business; at the present time that produced in the forest is said to do little more than pay expenses, and attention is being directed to the production of timber for paper pulp rather than charcoal. Thinning experiments are being undertaken with a view to ascertaining how the greatest yield of pulp wood and saw timber may be maintained.

In addition to sawn timber and pulp, the manufacture of doors, window frames, the match, wood wool and other industries absorb a great deal of labour.

Of the three common trees of Sweden it is possible that pine is the commonest, but in many directions there appears to be a distinct tendency for spruce to increase in area at the expense of pine. *Picea excelsa* under cultivation in Great Britain is a very variable tree in habit, size of leaves, cones, etc., and the same differences are noticeable when it is growing under natural conditions. Many specimens were examined in different parts of Sweden from trees growing upon wet, and upon drained land, and it was found that the same variations existed under all conditions. Side by side trees young and old were found with glabrous young shoots, or pubescent shoots, while others had only scattered hairs in the channels. At the same time some trees had almost horizontal branches, others drooping branches. On some trees the leaves were almost as short and dense as those of *Picea orientalis*, on others they were much longer and more thinly disposed. On certain trees the cones were 6 inches long, on others half that length. The cone scales were in some instances long, truncate and deeply notched, in others they were much shorter and almost as round as those of *Picea obovata*. The curious variety *virgata*, a rare tree in Swedish forests, was seen at Hornberga, and in that forest an area is composed of this variety. The trees vary a good deal in habit, but many produce the long gaunt branches peculiar to the variety. Seedlings raised from seeds from these trees exhibit a wide range of habit.

In the mountains about Åre spruce rarely ripens seed, and reproduction is almost entirely by branches from the lower parts of the

trunk, which take root and gradually form new trees, or from shoots appearing from dormant buds at the base of the trunk. These trees present a distinct and curious appearance.

The Scots pine also varies in habit and length of needles but the variation is in type rather than in indivdiual trees. Thus in the north the branch system is more compact and the needles shorter than in the south, in fact the northern type is known as *Pinus sylvestris* var. *lapponica*, and when growing in the colder regions it is said to retain its needles for 5 or 6 years. If taken southwards, however, its needles may be cast at the end of three years.

Both *Betula verrucosa* and *B. pubescens* are represented, the latter being known as *B. odorata*, and between them there are many hybrids. Of the two, *B. verrucosa* seemed to be the commoner tree.

The tour of forest areas was so arranged that the research work that is being carried out by the Swedish Institute of Experimental Forestry could be demonstrated. Sample plots, some of which have been under observation for many years, were examined in all the forests visited, and a great deal of information was forthcoming as to the rates of growth of trees growing on different soils and under different climatic conditions. On the whole fairly wide spacing is advocated for the mature crop, and in the northern forests it has been found that young trees must be well thinned, as with wide spacing the ground becomes warmer in early summer than with close spacing, hence a longer growing season is obtained. A good deal of experimental work is also in progress with regeneration problems. Mosses and lichens often cover the ground to a considerable depth in Swedish forests and such a covering does not encourage regeneration of trees, hence various methods of ground preparation are under trial. In the warmer parts of Sweden a certain quantity of seed is produced each year by the commoner trees with frequent good seed years, but in the colder parts good seed years are only at long intervals, averaged at 25 years. In some places where seeding experiments are being carried out, positions about 12 or 15 inches square are dug about 4 ft. apart, and in those positions a few seeds each of spruce and Scots pine, or of spruce, with the tree form of mountain pine (*Pinus montana* var. *uncinata*), and Scots pine, are sown, the object being to let the different kinds begin life together and prove by development which is the best species for the particular conditions. In some of the more northerly forests increment is very slow, although in some parts of Lappland the forests appeared to be as well stocked, and the individual trees to be as good as in more southerly regions. In the north the growing period is a very short one and as seed years are at very infrequent intervals, natural regeneration is a very slow process.

A company known as Kramfors Aktiebolag operates on a very extensive scale in Norrland and Lappland. This company owns about 939,000 acres of forest and employs a very efficient forest staff. In their Bosundet Forest near Hoting, which is about 3500

acres in extent and is situated at an altitude of 800 feet above sea level, the company's forest officers are carrying out extensive investigations on the effect of thinning upon the growth of trees and the soil temperature, and they have ascertained that by extensive thinning the soil temperature can be raised earlier in summer to a point that permits of tree growth than when closer stands of trees are left. They attach very great importance to the raising of the soil temperature by even a few days in advance of the normal on account of the naturally short growing season. In the third week of July of the present year, frost was still present in the soil, in dense stands, a little below the surface. In order to demonstrate how difficult the conditions prevailing in that region are, a small stand of Scots pine was pointed out. The trees had died during the present year, and on investigation it was found that the peat in which they were growing had become very wet at some period, and in the third week of July the roots were still coated with ice so that transpiration was impossible.

The firm has a nursery in this forest where experiments are being carried out with about 130 different kinds of foreign trees and shrubs.

As this firm is typical of the timber trade in Northern Sweden a few words on its origin and activities may be of interest. The founders were two traders, Erik Reselius and Johan Sellström and they, in conjunction with others, decided in 1742 to build a saw mill. They got an expert saw-mill builder, Christopher Kramm, to come over from Finland to build the mill and building was completed in 1744. By resolution of the Board of Trade, dated November 24th, 1744, the company was given permission to use a saw mill with fine-bladed saws at Sqvällsan or Kramfors, and until further provision, to fell trees in the valleys of the north and south rivers to the extent of 4,000 trees per annum, for sawing at the said fine-bladed mill. Round about this site have been erected the important buildings of Kramfors' industrial undertakings. From 4,000 trees cut in the earlier years there has now to be contrasted the 1927 total of 6,379,437. From the year 1745 to 1927 inclusive, the firm felled 91,300,899 trees. The firm could only develop as waterways were improved and floating operations made easier, therefore a good deal of pioneer work had to be undertaken in the Ångerman River and tributaries, by the improvement of the river bed, the erection of dams, guiding structures and so on. The company's logs are sorted at the Sandslån sorting booms previously described, and are taken from there to the respective mills by a fleet of tug boats.

At present the company exports 25,000 to 30,000 standards of timber per annum and 12,000 cubic fathoms of pit props. The number of logs required in 1927 for the production of 26,912 standards of sawn timber was 889,553. They have a sulphite pulp mill with a capacity of 58,000 tons per annum. In order to utilize the cellulose sugars in the spent digesting liquor from the sulphite

mill, there is a plant for the manufacture of alcohol. This has a yearly capacity of 1,200,000 litres of absolute alcohol. It is estimated that a log of 3 to 3½ cubic feet yields 1 litre of 50 per cent. alcohol. There is also a mill for the manufacture of sulphate pulp, with a capacity of 24,000 tons per annum. Wood pulp is sold by the company to 22 different countries. The company has its own electrical power station of about 18,000 effective horse power, at Edsele on the River Faxe about 90 kilometres from Kramfors. At the present time the company's own forests supply about 40 per cent. of the firm's timber requirements, 60 per cent. being purchased. The forests owned by the company are divided into 13 districts, each in charge of an inspector. These are subdivided and the sections are in charge of 30 foresters, the whole being under the control of Mr. E. Ronge, the Head of the Forestry Department. The company takes a great interest in the welfare of its employees and there are numerous official and semi-official organisations with this end in view. The above particulars are taken from memoranda provided by the company.

In a pamphlet entitled "Sweden and Her Forestry," published in Stockholm in 1928 for the Swedish Forestry Society, the following figures are given indicating the ownership of forest areas in the three provinces, Norrland, Svealand and Götaland :—State forests proper 3·8 million hectares ; other public forests 1·4 million hectares ; limited companies 6·7 million hectares ; large landlords 1·3 million hectares ; smaller landlords 10·4 million hectares. The same publication gives the total timber available in Sweden as 1,675 million cubic metres over bark measure, and the annual increment of the forests as 45·7 million cubic metres inside bark.

In a lecture given by Professor A. Wahlgren before the Swedish Forestry Society in 1928, some particulars are given regarding the present progress of Swedish forestry. The forestry question appears to have been given a good deal of attention during the nineteenth century but to have come in for much greater notice early in the present century and to have developed accordingly. He said :—

"The means by which this development has been furthered have, apart from the favourable economic conditions, been :

1. The State assuming a wider, properly balanced control of the care and management of private forests in conjunction with increased grants from public means towards private forestry ;

2. The establishment of a State Experimental Institute of Forestry whose task it was to enquire into the biological conditions for a good growth of forest and into the circumstances which affect an economic exploitation of the same ;

3. The transfer of the higher tuition in forestry to a College with a more scientific character, and an improvement in the tuition at the State Schools of Forestry ;

4. The support of forestry scientific research in other directions, *inter alia* by the establishment of a special fund, from which grants could be obtained for carrying out forestry scientific research ;

5. The organisation of societies for disseminating a knowledge and comprehension of conscientious dealing with matters relating to forestry."

He then, in the following words, describes the provisions made by Parliament for safeguarding future supplies, more particularly in the smaller privately-owned forests :—

" As long ago as the year 1903, Parliament passed a General Forestry Act, to come into force as from the year 1905, within those parts of the country where there were no special forestry laws. The main purport of this General Forestry Act was to secure satisfactory regeneration. For looking after the application of the Act there was established a separate and special Institution, the so-called Forest Conservation Board, one for each county revenue district within those parts of the country to which the Act applied. Every such Forestry Board, which consisted of 3 members, of which one was appointed as Chairman by the Crown, received at its disposal a highly-trained forestry man with the title of Länsjägmästare or County Forester and a number of County woodwards and Overseers. The Forestry Boards were given, each one within its district, a remarkably independent position, and were thus able to adapt their activity to the conditions prevailing within that district. They became not only the guardians of the Forestry Act and a controlling organ, but were furthermore given authority to carry on advisory, instructive and supporting work in respect of everything appertaining to the care and management of forests. Subsequently, Forestry Legislation has been amended and completed in various respects. The Forest Conservation Law of 1923 and now in force, only allows cutting in younger forests in the form of thinning in such way that the development of the forest is promoted. Besides that the Forestry Boards have been granted powers to prevent felling of timber for sale on such a scale that the estate in future may suffer from a shortage of timber for home requirements.

" The General Forestry Act in conjunction with the Forestry Boards and 'at the same time the firm and elastic manner in applying the same, as well as their zealous work of instruction' has been of remarkable importance to the improvement of forestry, particularly in the smaller tenement forests, and one can now see farm-forests, which in such respect are on a very high level of excellence."

Young forest officers in Sweden receive four years' training, partly in the forest and partly in the College of Forestry in Stockholm. One department of this College has its summer headquarters for practical training in the forest of Malingsbo, and this was visited during the tour. The College of Forestry in Stockholm is a fine building and it appears to be very well equipped for teaching purposes.

Including British Colonies, the International Congress of Forestry Research Stations was attended by representatives of 31 countries. The Director of Kew also attended, unofficially, the Congress and the excursions. A very wide range of subjects was brought forward for discussion and the languages used were English, French and German. All the arrangements were in the hands of The Swedish Institute of Experimental Forestry, with Professor Hesselman as President, and Jägmästare Sven Petrini as Secretary. The organisation was excellent in every way. From commencement to finish everything was carried out according to time-table. This was no light work considering the large number of delegates, the wide extent of country covered, and the language difficulties. The various members of the Swedish Committee were courteous to all and did their utmost to make everyone comfortable and the Congress a success. At the same time private estate owners, companies, and municipal bodies assisted very materially towards the success of the tours and were most generous in their entertainment of the delegates.

LI.—MISCELLANEOUS NOTES.

The following appointments at the Royal Botanic Gardens, Kew, have been made by the Minister of Agriculture and Fisheries:—MR. F. BALLARD, B.Sc., to be an Assistant (Herbarium) in succession to Mr. C. H. Wright (*K.B.* 1929, p. 139, p. 265); Mr. C. E. HUBBARD (*K.B.* 1929, p. 139) to be a Temporary Assistant, and MR. A. A. BULLOCK, B.Sc., to be a Temporary Sub-Assistant in the Herbarium.

MR. ARTHUR BENNETT died on May 2nd, 1929, at Croydon, where he was born on June the 9th, 1844, and had spent the whole of his life. Although engaged in business, he devoted his spare time to the study of botany (both in the field and in herbaria) and became an authority on aquatic plants (especially Potamogetons) and Cyperaceae. His earliest publication was "On *Potamogeton lanceolatus*" in the Journal of Botany, 1881, p. 65. He was so prolific a writer that in the Royal Society's Catalogue covering the period from 1884 to 1900 the titles of his publications occupy four columns. He contributed the accounts of *Naiadaceae* to the Flora Capensis in 1897, and to the Flora of Tropical Africa in 1901. His critical knowledge of the plants he specially studied led to his receiving correspondence from botanists all over the world, and he was noted for the promptness with which he answered these enquiries. His disposition, in spite of many private troubles, was genial and unassuming, and he was ever ready to place his knowledge at the disposal of others, as the writer has experienced during Bennett's many visits to Kew.

His herbarium (except the Potamogetons) was purchased in 1906 by Mr. C. B. Clarke, who generously presented it to Kew, and at

Mr. Bennett's desire his British Potamogetons were sent after his death to the British Museum, and his exotic ones, with many critical notes, to Kew.

Arthur Bennett was elected a Fellow of the Linnean Society in March, 1881, and for many years was a most regular attendant at its meetings, but, when the illness of his brother and partner in business made increased calls on his time, he resigned in 1905, but was elected an Associate in December, 1910.

He was buried in the Mitcham Road Cemetery, Croydon.

C. H. W.

Professor Dr. Hans Schinz has retired from the post of Director of the Botanical Museum of the University of Zürich. For upwards of forty years Professor Schinz has been in correspondence with Kew and during this long period has made many valuable contributions to the Herbarium, Library, and Gardens. In his earliest letters, written in the year following his travels in South-West Africa in 1884-87, he sought the co-operation of the Kew staff in naming the botanical specimens he had collected. A large number of these were afterwards presented. Altogether he has enriched the Herbarium with some thousands of specimens, obtained chiefly from South-west and other parts of Africa. He has always been willing to lend material required in the preparation of the African floras and in the revision of various genera. Professor Schinz made it a rule to send to Kew all his own botanical publications. A reference to the Library Catalogue shows that these have been numerous and important. In addition he has sent all the studies of his pupils and others which have been issued as "Mitteilungen aus dem Botanischen Museum der Universität Zürich." Of these Mitteilungen, which are reprints from various periodicals or in many cases independent works, 132 have now been published. They include many elaborate treatises, amongst them being the late Dr. Thellung's "Die Gattung Lepidium" (1906), and "La flore adventice de Montpellier" (1912). One of the latest presentations to the Library by Professor Schinz is a copy of the Festschrift published last December on the occasion of the 70th anniversary of his birth. He is succeeded by Professor Dr. A. V. Däniker.

Forests and Climate*.—Mr. Nicholson, who is Forest Adviser to the Governments of Kenya and Uganda, and who has had considerable experience of Forestry in India, here sets out the results of his observations on the relation of forests and rainfall in that part of East Africa in which he has recently worked. His treatment of the subject is, for the greater part of the publication, a criticism of the

*The Influence of Forests on Climate and Water Supply in Kenya, by J. W. Nicholson, with a Foreword by A. Walter. Forest Department Pamphlet No. 2. Colony and Protectorate of Kenya. The East African Standard Ltd., Nairobi, 1929, pp. 40.

latest pronouncements of the meteorological experts on the subject, and in the main he is not inclined to endorse their findings. His objections are that they are too generalised, and that they attempt to treat a greatly diversified subject in too summary a manner. His criticisms based on his own observations in the field, lead him to the conclusion that forests exert a far greater effect on rainfall than meteorologists are inclined to admit. It is, in fact, another case of the field worker contrasting his experience with the deductions of the expert working from statistics in the office. The instances Mr. Nicholson quotes from Uganda and Kenya lend support to the general conclusions at which he arrives, but which he states he only advances on behalf of East Africa.

Briefly these conclusions are, that changes in the covering of vegetation may enormously affect the total rainfall; that trees and deep-rooted shrubs contribute more moisture to the air than herbaceous vegetation or bare soil; that the mountain forests of East Africa can induce occult precipitation up to at least 25 per cent. of the total annual rainfall; that forests have little influence on cyclonic rain; that the local effect of forests on monsoon rainfall is up to 3 per cent. but the regional effect may be greater; that instability rain is greatly increased by the presence of forests.

The general and local effects of forests and stream flow, and the value of windbreaks, are discussed in the concluding chapters.

Mr. A. Walter, who has been appointed Director of the new British East African Meteorological Service, contributes a Foreword, in which he emphasises the importance of the study of forests in their relation to climate.

This pamphlet reopens a question which appeared to have been settled at a discussion before a recent meeting of the British Association, and in a recent paper before the Royal Meteorological Society. It would seem that the subject will receive considerable further attention now that more observations will be able to be carried out in equatorial regions.

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